CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: 01/19/2021

TO: Sarah Donoughe – NER

FROM: Wade Strickland – WY/3 Nicole Krueger

SUBJECT: Water Quality-Based Effluent Limitations for Agropur Inc Luxemburg
WPDES Permit No. WI-0050237-09

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using Chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from Agropur Inc in Kewaunee County. This industrial wastewater treatment facility (WWTF) discharges to the Tributary to the East Twin River, located in the East Twin River Watershed in the North East Lakeshore Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 009:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD_5	40 mg/L 158 lbs/day			20 mg/L 79 lbs/day		1,3
TSS	40 mg/L 201 lbs/day			20 mg/L 100 lbs/day		1,3
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen		4.0 mg/L				1
Ammonia Nitrogen						1,2
Chloride	**440 mg/L**		400 mg/L 3,281 lbs/day	**400 mg/L**		1,4
Nickel						2
Phosphorus LCA Interim Limit HAC Interim Limit Final WQBEL				0.5 mg/L 0.4 mg/L 0.225 mg/L	0.075 mg/L 0.64 lbs/day	5
Temperature	86 °F					1
Nitrite + Nitrate						2,6
Nitrogen, Total Kjeldahl						2,6
Total Nitrogen						2,6
Acute WET						7,8
Chronic WET				1.0 TUc		7,8

Footnotes:

1. No changes from the current permit.
2. Monitoring only.
3. The mass limits are categorical limits based on ch. NR 240, Wis. Adm. Code. These limits are addressed in the technology-based effluent limits memo dated 12/18/2020.

4. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7) are included in bold.
5. Under the phosphorus MDV, a level currently achievable (LCA) interim limit of 0.5 mg/L should be effective upon permit reissuance. A compliance schedule may be included in the permit until the highest attainable condition (HAC) limit of 0.4 mg/L can be met. The final WQBELs remain at 0.225 mg/L as a monthly average and 0.075 mg/L as a six-month average, as well as a respective mass limit.
6. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, quarterly total nitrogen (total kjeldahl nitrogen and nitrate/nitrite) monitoring is recommended for facilities with total nitrogen greater than 40 mg/L and class A cheese plants. Total Nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total kjeldahl nitrogen (all expressed as N).
7. Acute WET testing is recommended 2x during the permit term and chronic WET testing is recommended 2x annually. The Instream Waste Concentration (IWC) to assess chronic test results is 100%. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 75%, 50%, 25% & 12.5% and the dilution water used in WET tests conducted on Outfall 009 shall be a grab sample collected from the East Twin River, upstream and out of the influence of the mixing zone and any other known discharge.
8. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Nicole Krueger at Nicole.Krueger@wisconsin.gov or Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (2) – Narrative & Outfall Map

PREPARED BY: Nicole Krueger, Water Resources Engineer – SER

E-cc: Laura Gerold, Wastewater Engineer – NER
Heidi Schmitt Marquez, Regional Wastewater Supervisor – NER
Diane Figiel, Water Resources Engineer – WY/3
Kari Fleming, Environmental Toxicologist – WY/3

Attachment #1

Water Quality-Based Effluent Limitations for
Agropur Inc. Luxemburg

WPDES Permit No. WI-0050237-09

Prepared by: Nicole Krueger

PART 1 – BACKGROUND INFORMATION

Facility Description:
Agropur Inc in Luxemburg operates a cheese manufacturing and whey processing facility in southern Kewaunee County. The facility and wastewater treatment plant were upgraded in 2014 to accommodate an increased flow from production increase. The WWTF currently consists of an equalization tank, anaerobic conditioning tank, two anaerobic digesters, anoxic selector tank, aeration basin, secondary clarification, post aeration tank, and two DAFs for sludge thickening. Chemical addition of ferric chloride and polymer are still added for phosphorus removal and additional sludge thickening and solids removal, respectively. Outfall 009 discharges to an unnamed tributary of the East Twin River and consists of the combination of treated process wastewater, excess polished condensate of whey (COW), retentate from the industrial reverse osmosis (RO) unit, and noncontact cooling water (NCCW). High strength wastewater that was previously segregated and land applied is now treated in the WWTF and discharged as treated process wastewater. The facility still has the option of segregating high strength waste for land application to approved sites and storage facilities via Outfall 002 as necessary. The high strength wastewater could be comprised of whey, whey-by-products, permeate, antibiotic contaminated milk, separator desludge &/or cooker water. Sludge from the WWTF was previously land applied on approved sites via Outfall 004 but is now disposed of at a landfill. The facility still has the option of land applying sludge to approved sites via Outfall 004 if that is deemed necessary. An additional emergency outfall (005) has been retained for land application of untreated process wastewater in the event of an emergency.

Attachment #2 is a map of the area showing the approximate location of Outfall 009.

Existing Permit Limitations: The current permit, expiring on 03/31/2021, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						
BOD_5	40 mg/L 158 lbs/day			20 mg/L 79 lbs/day		
TSS	40 mg/L 201 lbs/day			20 mg/L 100 lbs/day		
Dissolved Oxygen		4.0 mg/L				1
pH	9.0 s.u.	6.0 s.u.				1
Temperature Interim Final	 120 deg F 86 deg F					
Phosphorus Interim				 0.72 mg/L		2

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Final				0.225 mg/L	0.075 mg/L 0.64 lbs/day	
Chloride			400 mg/L 3,281 lbs/day			
Ammonia Nitrogen						3
Acute WET						4
Chronic WET						4

Footnotes:

1. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
2. A compliance schedule is in the current permit to meet the final WQBEL by April 1, 2023.
3. Monitoring only.
4. Acute WET tests are required twice during the permit term and chronic WET tests are required annually. The instream waste concentration (IWC) is 100%.

Receiving Water Information:

- Name: Tributary to East Twin River (WBIC 3000213)
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: The immediate receiving stream (WBIC 3000213) and the next stream downstream (WBIC 3000212) to where it meets the unnamed tributary to the East Twin River (approximately 1.5 miles downstream of the outfall) is classified as limited aquatic life (LAL). The unnamed tributary to the East Twin River (WBIC 3000211) has a warmwater sport fishery (WWSF) classification. The East Twin River (WBIC 84000), approximately 3 miles downstream of the outfall, has a coldwater classification. (Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.)
- Low Flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code:
  - The following 7-Q_{10} and 7-Q_2 values are estimated from USGS, where Outfall 001 is located and at the unnamed tributary to the East Twin River where the classification changes to WWSF:
    7-Q_{10} = 0 cfs (cubic feet per second)
    7-Q_2 = 0 cfs
  - Downstream flows approximately 3 miles from the Outfall at the East Twin River from the WPDES Viewer (coldwater classification):
    7-Q_{10} = 0.24 cfs
    7-Q_2 = 0.72 cfs
- Hardness = 326 mg/L as $CaCO_3$. This value represents the geometric mean of data from the permit reissuance application from 07/15/2020 to 05/12/2020. Effluent hardness is used in place of receiving water because there is no receiving water flow upstream of the discharge.
- % of low flow used to calculate limits in accordance with s. NR 106.06 (4) (c) 5., Wis. Adm. Code: Not applicable where the receiving water low flows are zero.
- Source of background concentration data: Background concentrations are not included because they don't impact the calculated WQBEL when the receiving water low flows are equal to zero.
- Multiple dischargers: None
- Impaired water status: The direct receiving water is listed as 303(d) impaired for total phosphorus as

well as the downstream tributaries and the East Twin River.

Effluent Information:

- Flow Rate(s):
  Maximum Annual average = 0.68 MGD (Million Gallons per Day)
  For reference, the actual average flow from 04/01/2016 to 08/31/2020 was 0.65 MGD.
- Hardness = 326 mg/L as $CaCO_3$. This value represents the geometric mean of data from 07/15/2020 to 05/12/2020 from the permit application.
- Acute dilution factor used in accordance with s. NR 106.06 (3) (c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water Source: Private wells
- Additives: 8 water quality conditioners and 1 biocide are used at the facility, listed in the additives section in this memo.
- Effluent characterization: This facility is categorized as a secondary industry, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus hardness. Permit-required monitoring for ammonia, chloride, and phosphorus was used in this evaluation.

	Chloride mg/L	Chloride lbs/day
1-day P_{99}	362	2090
4-day P_{99}	307	1721
30-day P_{99}	276	1513
Mean	259	1402
Std	38.7	252
Sample size	462	462
Range	85 – 420	361 – 2532

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled “MEAN EFFL. CONC.”.

The following table presents the average concentrations and loadings at Outfall 009 from 04/01/2016 to 08/31/2020 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

	Average Measurement	Average Mass Discharged
BOD_5	1.75 mg/L*	6.66 lbs/day
TSS	3.46 mg/L*	18.4 lbs/day
pH field	7.59 s.u.	
Phosphorus	0.35 mg/L	
Ammonia Nitrogen	0.08 mg/L*	
Dissolved Oxygen	6.86 mg/L	

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

Attachment #1

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P_{99}) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q_{10}

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q_{10} receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards.

$$\text{Limitation} = \frac{(WQC)\,(Qs + (1-f)\,Qe) - (Qs - f\,Qe)\,(Cs)}{Qe}$$

Where:

WQC =Acute toxicity criterion or secondary acute value according to ch. NR 105

Qs = average minimum 1-day flow which occurs once in 10 years (1-day Q_{10}) if the 1-day Q_{10} flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q_{10}).

Qe = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

Cs = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q_{10} method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is the case for Agropur.

The following tables list the calculated water quality-based effluent limitations for this discharge along with the results of effluent sampling. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 0 cfs

SUBSTANCE	REF. HARD.* mg/L	ATC	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Chlorine		19.0	19.0	3.81	8		
Arsenic		340	340	68.0	<2.6		

Attachment #1

SUBSTANCE	REF. HARD.* mg/L	ATC	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Chlorine		19.0	19.0	3.81	8		
Cadmium	326	40.0	40.0	8.0	<0.19		
Chromium	301	4446	4446	889	<0.83		
Copper	326	47.3	47.3	9.5	<1.9		
Lead	326	335	335	67.0	<4.3		
Nickel	268	1080	1080	216	33.6		
Zinc	326	338	338	67.7	7.9		
Chloride (mg/L)		757	757			326	420

* The indicated hardness may differ from the effluent hardness because the effluent hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the acute criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

* * Per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016 consideration of ambient concentrations and 1-Q_{10} flow rates yields a more restrictive limit than the 2 × ATC method of limit calculation.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 0 cfs

SUBSTANCE	REF. HARD.* mg/L	CTC	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Chlorine		7.28	7.28	1.46	8	
Arsenic		152.2	152	30.4	<2.6	
Cadmium	175	3.82	3.82	0.8	<0.19	
Chromium	301	325.75	326	65.2	<0.83	
Copper	326	28.45	28.5	5.69	<1.9	
Lead	326	87.72	87.7	17.5	<4.3	
Nickel	268	169.08	169	33.8	33.6	
Zinc	326	338.34	338	67.7	7.9	
Chloride (mg/L)		395	395			307

* The indicated hardness may differ from the receiving water hardness because the receiving water hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the chronic criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

Monthly Average Limits based on Wildlife Criteria (WC)

The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Attachment #1

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 0 cfs

SUBSTANCE	HTC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	880	880	176.0	<0.19
Chromium (+3)	8400000	8400000	1680000	<0.83
Lead	2240	2240	448.0	<4.3
Nickel	110000	110000	22000	33.6

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 0 cfs

SUBSTANCE	HCC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3	13.3	2.66	<2.6

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because no effluent limits are needed based on HCC, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations: Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are required for chloride.

Chlorine - Available data/information indicates the discharge contains concentrations of chlorine or halogen above the applicable WQBELs of 19 µg/L as a daily maximum and 7.3 µg/L as a weekly average. Because the reported concentration of 8 µg/L is less than the typical normally achievable detection levels of 50-100 µg/L, and because chlorine isn't used in treatment, **no chlorine limits are recommended in the reissued permit.**

Chloride – Considering available effluent data from the current permit term (04/01/2016 to 08/31/2020), the 1-day P_{99} chloride concentration is 420 mg/L, and the 4-day P_{99} of effluent data is 307 mg/L. These effluent concentrations are below the calculated WQBELs for chloride, but **there is currently a weekly average limit of 400 mg/L which is recommended to continue in the reissued permit** to meet antibacklsiding purposes**.** The current permit also has a mass chloride limit of 3,281 lbs/day as a weekly average which is recommended to continue in the reissued permit. This was calculated in 2016 in response to an antidegradation demonstration because of anticipated increase in production and the future peak flow of 1.03 MGD as included in their 2013 design plan. The mass limit is based on 1/3rd of the available assimilative capacity in the receiving water. See the expression of limits section of this memo for additional limits.

Nickel – Nickel data from 12/10/2010 to 07/15/2020 was used to calculate the effluent average concentration to compare to 1/5th of the calculated limit.

Attachment #1

Sample Date	Nickel µg/L
12/10/2010	10
08/09/2011	2.3
04/14/2015	34
07/15/2020	88
Average	33.6

Monitoring for one year is recommended in the reissued permit so that more representative data can be collected and compared to the calculated limit because the available data is very close to $1/5^{th}$ of the calculated weekly average limit.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Given the fact that Agropur does not currently have ammonia nitrogen limits the need for limits is evaluated at this time.

Effluent Data
The following table evaluates the statistics based upon ammonia data reported from 04/01/2016 to 08/31/2020.

Ammonia Nitrogen mg/L	April - May	June - September	October - March
1-day P_{99}	0.5	0.4	0.4
4-day P_{99}	0.3	0.2	0.2
30-day P_{99}	0.14	0.11	0.12
Mean*	0.09	0.07	0.08
Std	0.10	0.08	0.08
Sample size	87	167	208
Range	0.028 – 0.78	0.025 – 0.67	0.026 – 0.64

*Values lower than the level of detection were substituted with a zero

This data is significantly lower than the most restrictive limits that would be calculated limits for the immediate classification of LAL and the downstream classifications of warmwater sport fish and coldwater. Therefore, **no limits are needed, however monitoring is recommended to continue.**

PART 4 – PHOSPHORUS

Technology Based Phosphorus Limit
Subchapter II of Chapter NR 217, Wis. Adm. Code, requires industries that discharge greater than 60 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Because Agropur currently has a limit of 0.72 mg/L, this limit should be included in the reissued permit. This limit remains applicable unless a more stringent water quality-based concentration limit is given.

In addition, the need for a WQBEL for phosphorus must be considered.

Water Quality-Based Effluent Limits (WQBEL)
Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

Phosphorus criteria in s. NR 102.06, Wis. Adm. Code, do not apply to limited aquatic life waters [s. NR 102.06 (6) (d)]. These waters were not included in the USGS/WDNR stream and river studies and, therefore, the Department lacked the technical basis to determine and propose applicable criteria. At some time in the future, the Department may adopt phosphorus criteria based on new studies focusing on limited aquatic life waters. The Guidance for Implementing Wisconsin's Phosphorus Water Quality Standards for Point Source Discharges (2020) suggests that during the interim, WQBELs should be based on the criteria and flow conditions for the next stream segment downstream (or downstream lake or reservoir, if appropriate), since ss. 217.12 and 217.13, Wis. Adm. Code, state that the Department must set WQBELs to protect downstream waters. The discharge location of the wastewater from Agropur is classified as limited aquatic life downstream from the point of discharge downstream to the unnamed tributary to the East Twin River approximately 1.5 miles downstream of the outfall. The unnamed tributary to the East Twin River is classified for warm water sport fishery uses, and phosphorus WQBELs are calculated to be proactive of this downstream water.

The conservation of mass equation is described in s. NR 217.13 (2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs):

$$\text{Limitation} = [(WQC)(Qs+(1-f)\ Qe) - (Qs-f\ Qe)\ (Cs)]/Qe$$

Where:

WQC = 0.075 mg/L for unnamed tributary to East Twin River
Qs = 100% of the 7-Q_2 of 0 cfs
Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code
Qe = effluent flow rate = 0.68 MGD = 1.05 cfs
f = the fraction of effluent withdrawn from the receiving water = 0

Since the receiving water flow is equal to zero, the effluent limit is set equal to criteria.

Effluent Data
The following table summarizes effluent total phosphorus monitoring data from 04/01/2016 to 08/31/2020.

Attachment #1

	Phosphorus mg/L
1-day P_{99}	0.70
4-day P_{99}	0.50
30-day P_{99}	0.40
Mean	0.34
Std	0.12
Sample size	461
Range	0.078 – 0.92

Reasonable Potential Determination
The calculated WQBEL of 0.075 mg/L is less than the current monthly limit of 0.72 mg/L, so the WQBEL must be included in the permit per s. NR 217.15(2), Wis. Adm. Code.

In accordance with s. NR 217.15(2), Wis. Adm. Code, there is reasonable potential for the discharge to cause or contribute to an exceedance of the water quality criteria. The data suggest that a compliance schedule will be necessary for the facility to meet the given phosphorus limits.

Limit Expression
According to s. NR 217.14 (2), Wis. Adm. Code, because the calculated WQBEL is less than or equal to 0.3 mg/L, the effluent limit of 0.075 mg/L may be expressed as a six-month average. If a concentration limitation expressed as a six-month average is included in the permit, a monthly average concentration limitation of 0.225 mg/L, equal to three times the WQBEL calculated under s. NR 217.13, Wis. Adm. Code shall also be included in the permit. The six-month average should be averaged during the months of May – October and November – April.

Mass Limits
Because the discharge is to a surface water that is to or upstream of Lake Michigan, a mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code. **This final mass limit shall be 0.075 mg/L × 8.34 × 1.03 MGD = 0.64 lbs/day expressed as a six-month average.** The design flow rate of 1.03 MGD was used because of anticipated increase in production which was included in Agropur's 2013 design plan.

Multi-Discharge Variance Interim Limit
With the permit application, Agropur has applied for the phosphorus multi-discharger variance (MDV). Conditions of the phosphorus MDV require the facility to comply with an interim phosphorus limit in lieu of meeting the final WQBEL. Section 283.16 (6) 1, Wis. Stats. requires an interim limit of 0.8 mg/L as a monthly average for the first permit term under the MDV. However, if 0.8 mg/L does not represent the highest attainable condition, a more stringent limit should be met by the end of the permit term pursuant s. 283.16 (7), Wis. Stats. Since Agropur has shown the ability to treat below 0.8 mg/L, a more stringent limit is required. The recommended interim limit is 0.4 mg/L as a monthly average. A compliance schedule may be appropriate to meet this interim limit but compliance with 0.4 mg/L shall be no later than the end of the reissued permit.

The effluent data indicates that 4-day P_{99} value of **0.5 mg/L is a level currently achievable (LCA)** for the discharge. A limit of 0.5 mg/L as a monthly average should not be exceeded during the compliance schedule.

TMDL Under Development
A Total Maximum Daily Load (TMDL) is being developed for the Northeast Lakeshore for phosphorus. The TMDL will address phosphorus water quality impairments within the basins and provide waste load allocations (WLA) required to meet water quality standards. This TMDL will likely result in phosphorus limitations that must be included in WPDES permits, which may be different than those calculated in this WQBEL memo. TMDL-derived phosphorus limits may be included in lieu of or in addition to the calculated limits upon permit reissuance or modification once the TMDL has been approved by U.S. EPA, according to s. NR 217.16, Wis. Adm. Code.

PART 5 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in Chapters NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. The daily maximum effluent temperature limitation shall be 86 °F for discharges to surface waters classified as Limited Aquatic Life according to s. NR 104.02(3)(b)1, Wis. Adm. Code, except for those classified as wastewater effluent channels and wetlands regulated under ch. NR 103 [s. NR 106.55(2), Wis. Adm. Code] which has a daily maximum effluent temperature limitation of 120 ºF.

Reasonable Potential
Based on the available discharge temperature data from August 2018 to August 2020 shown below, the maximum daily effluent temperature reported was 100° F.

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	80	85	-	86
FEB	82	84	-	86
MAR	83	84	-	86
APR	88	88	-	86
MAY	89	92	-	86
JUN	96	97	-	86
JUL	98	100	-	86
AUG	96	96	-	86
SEP	89	94	-	86
OCT	88	91	-	86
NOV	82	86	-	86
DEC	83	84	-	86

Agropur installed one cooling tower to their wastewater treatment facility in 2018 and installed two additional cooling towers in 2019 in order to meet the daily maximum temperature limit of 86 °F.

Temperature data prior to installation of the cooling towers were removed from this table because it is not representative of current conditions. **Because the facility has included a treatment to meet the daily maximum limit of 86 °F, it is recommended to continue this limit in the reissued permit year-round.**

PART 6 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the WET Program Guidance Document (October 29, 2019).

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09 (2) (b), Wis. Adm Code.
- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09 (3) (b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 100% shown in the WET Checklist summary below was calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm Code:

$$\text{IWC (as \%)} = Q_e \div \{(1 - f)\, Q_e + Q_s\} \times 100$$

Where:

Q_e = annual average flow = 0.68 MGD = 1.05 cfs
f = fraction of the Q_e withdrawn from the receiving water = 0
Q_s = ¼ of the 7-Q_{10} = 0 cfs ÷ 4 = 0 cfs

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.
- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 009 shall be a grab sample collected from the East Twin River, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.
- Shown below is a tabulation of all available WET data for Outfall 009. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08 (3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

Attachment #1

WET Data History

Date initiated	Lab	Test Type	Acute Test Results		Pass/ Fail	Chronic Test Results			Pass/ Fail	Comments
			Fathead minnow LC50	*C. dubia LC50*		Fathead minnow IC25	*C. dubia IC25*	*S. capri IC50*		
12/13/2016	Pace	WPDES compliance	>100	>100	Pass	>100	>100	---	Pass	C. dubia chronic restarted on 12/13/16 due to late arrival of #3 sample in 11/29/16 test
06/27/2017	Pace	WPDES compliance	---	---	---	>100	>100	---	Pass	
02/06/2018	Pace	WPDES compliance	---	---	---	>100	9.78	---	Fail	2 retests required
03/27/2018	SLH	DNR Request	>100	>100	Pass	>100	21.4	>100	Fail	
05/01/2018	ECT	Retest	---	---	---	>100	60.8	---	Fail	02/06/18 #1 retest; Requested to postpone retest #2 until after TRE
08/07/2018	SLH	DNR Request	>100	>100	Pass	>100	>100	>100	Pass	
12/04/2018	SLH	DNR Request	>100	>100	Pass	>100	>100	>100	Pass	
01/22/2019	ECT	Other - TRE screen	---	---	---	---	>100	---	Pass	C. dubia only tested
02/19/2019	ECT	Other - TRE screen	---	---	---	---	>100	---	Pass	C. dubia only tested
05/14/2019	ECT	Other - TRE screen	---	---	---	---	>100	---	Pass	C. dubia only tested
07/30/2019	ECT	WPDES compliance	---	---	---	>100	>100	---	Pass	02/06/18 #2 retest
08/13/2019	ECT	WPDES compliance	>100	>100	Pass	>100	>100	---	Pass	Makeup of Oct-Dec 2018 test
11/12/2019	ECT	WPDES compliance	---	---	---	>100	>100	---	Pass	Makeup of Jul-Sep 2019 test.
12/16/2019	ECT	TRE Report	---	---	---	---	---	---	---	1
12/10/2019	SLH	DNR Request	>100	>100	Pass	>100	6.3	>100	Fail	
03/10/2020	ECT	Other - TRE screen	---	---	---	---	>100	---	Pass	C. dubia only tested
04/24/2020		TRE Update	---	---	---	---	---	---	---	2
04/28/2020	ECT	Other - TRE screen	---	---	---	---	>100	---	Pass	C. dubia only tested; #3 sample arrived late & was not used
05/12/2020	ECT	Other - TRE screen	---	---	---	---	>100	---	Pass	C. dubia only tested; #3 sample arrived late & was not used
06/16/2020	ECT	Other - TRE screen	---	---	---	---	84.4	---	Fail	3
07/28/2020	ECT	Other - TRE screen	---	---	---	---	>100	---	Pass	C. dubia only tested

Footnotes:

1. Agropur submitted Final TRE report 12/16/19. Report stated that TIE identified DAF surfactant as possible toxicant. Conducted tox tests on 5 products; 2 used above levels expected to cause chronic toxicity. Analyses showed products contained high surfactant concentrations. Agropur reduced usage levels and replaced products with high surfactant levels.
2. Agropur stated anaerobic digestion began to falter about same time as this test. Noted a significant drop off in treatment efficiency, biogas generation and an increase in volatile fatty acid formation over previous several months. Believe this indicated toxic conditions in digestor. Found high quaternary compound concentrations in biosolids & digestor effluent. Began feeding Neutra-Quat into digestor 2/12/20. Digestor began to recover a few days later.
3. C. dubia only tested; Lab suggested iron related impacts, due to observations that young died before hatching. Agropur didn't use any additional FeCl during this period so not sure of cause.

- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the

predicted value. **WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.**

Acute Reasonable Potential = [(TUa effluent) (B)]
Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

According to s. NR 106.08(6)(d), Wis. Adm. Code, TUa and TUc effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC_{50}, IC_{25} or $IC_{50} \geq 100\%$).

Acute Reasonable Potential = 0 < 1.0, reasonable potential is not shown, and a limit is not required.

Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

TUc (maximum) $100/IC_{25}$	**B** (multiplication factor from s. NR 106.08(5)(c), Wis. Adm. Code, Table 4)	IWC
100/6.3 = 15.9	2.3 Based on 5 detects	100%

[(TUc effluent) (B)(IWC)] = 36.5 > 1.0

Therefore, reasonable potential is shown for chronic WET limits using the procedures in s. NR 106.08(6) and representative data from 12/13/2016 to 07/28/2020.

Expression of WET limits

Acute WET limit = 1.0 TU_a (daily maximum)
Chronic WET limit = [100/IWC] TU_c = 1.0 TU_c expressed as a monthly average

The WET Checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The Checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The Checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the Checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET Checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET Checklist, see Chapter 1.3 of the WET Guidance Document: http://dnr.wi.gov/topic/wastewater/WETguidance.html.

WET Checklist Summary

	Acute	**Chronic**
AMZ/IWC	Not Applicable. **0 Points**	IWC = 100%. **15 Points**
Historical Data	6 tests used to calculate RP. No tests failed. **0 Points**	19 tests used to calculate RP. 5 tests failed. **0 Points**

Attachment #1

	Acute	Chronic
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. **0 Points**	Same as Acute. **0 Points**
Receiving Water Classification	LAL, less than 4 miles to full fish and aquatic life classification **5 Points**	Same as Acute. **5 Points**
Chemical-Specific Data	Reasonable potential for limits for no substances based on ATC; Ammonia nitrogen limit carried over from the current permit. Nickel, zinc, ammonia, and chloride detected. Additional Compounds of Concern: None **3 Points**	Reasonable potential limits for no substances based on CTC; Nickel, zinc, ammonia, and chloride detected. Ammonia nitrogen limit carried over from the current permit. Additional Compounds of Concern: None **8 Points**
Additives	1 Biocides and 8 Water Quality Conditioners added. P treatment chemical other than Ferric Chloride (FeCl), Ferrous Sulfate ($FeSO_4$), or alum used: No **11 Points**	All additives used more than once per 4 days. **11 Points**
Discharge Category	Dairy facility **5 Points**	Same as Acute. **5 Points**
Wastewater Treatment	Secondary or Better **0 Points**	Same as Acute. **0 Points**
Downstream Impacts	Water quality assessments from 2011 and 2017 show toxicity in the receiving water. **5 Points**	Same as Acute. **5 Points**
Total Checklist Points:	**29 Points**	**49 Points**
Recommended Monitoring Frequency (from Checklist):	2 tests in permit term	2x yearly
Limit Required?	No	Yes Limit = 1.0 TU_c
TRE Recommended? (from Checklist)	No	No

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2019) and other information described above 2x during permit term acute and 2x yearly chronic WET tests are recommended in the reissued permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).
- According to the requirements specified in s. NR 106.08, Wis. Adm. Code, a chronic WET limit is required. The chronic WET limit shall be expressed as 1.0 TUc as a monthly average in the effluent limits table of the permit.

- A minimum of annual chronic monitoring is required because a chronic WET limit is required. Federal regulations in 40 CFR Part 122.44(i) require that monitoring occur at least once per year when a limit is present. The checklist recommendation for 2x yearly monitoring satisfies this requirement.

PART 7 – EXPRESSION OF LIMITS

Revisions to chs. NR 106 and 205, Wis. Adm. Code align Wisconsin's water quality-based effluent limits with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

Agropur is an industrial discharge and is therefore subject to daily maximum and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with these rules or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, pH, and *E. coli* among other parameters. Mass limitations are not subject to the limit expression requirements if concentrations limits are given.

Method for calculation:
The methods for calculating limitations for industrial discharges to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(4), Wis. Adm. Code, as follows:

1. Whenever a daily maximum limitation is determined necessary to protect water quality, a monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.
2. Whenever a weekly average limitation is determined necessary to protect water quality:
    - A monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.
        - Chloride – A weekly average limit of 400 mg/L is needed so a monthly average limit is needed, set equal to the monthly average limit.
    - A daily maximum limitation shall also be included in the permit and set equal to the daily maximum WQBEL calculated under s. NR 106.06 or a daily maximum limitation calculated using the following procedure, whichever is more restrictive:

      Daily Maximum Limitation= WQBELc × DMF

      Where:

      DMF = Daily Multiplication Factor as defined in Table 2

      CV = coefficient of variation (CV) as calculated in s. NR 106.07(5m)

s. NR 106.07 (4) (e). Table 2 — Daily Multiplication Factor

CV	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
DMF	1.114	1.235	1.359	1.460	1.557	1.639	1.712	1.764	1.802	1.828

CV	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0

DMF	1.842	1.849	1.851	1.843	1.830	1.815	1.801	1.781	1.751	1.744

- Chloride – A daily maximum limit of 440 mg/L is recommended. This limit is equal to 395 mg/L x 1.114. The multiplication factor of 1.114 is derived based on the CV of 0.1 calculated from chloride monitoring data collected.

3. Whenever a monthly average limitation is determined necessary to protect water quality, a daily maximum limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

   Daily Maximum Limit = (Monthly Average Limitation × MF)

   Where:

   MF= Multiplication factor as defined in Table 1

   CV= coefficient of variation (CV) as calculated in s. NR 106.07(5m)

   n= the number of samples per month required in the permit

s. NR 106.07 (3) (e) 4. Table 1 — Multiplication Factor (for CV = 0.6)

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.6	1.00	1.31	1.51	1.64	1.95	2.12	2.23	2.30	2.36	2.43

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

Summary of Additional Limitations:

In conclusion, the following additional limitations are required to comply with ss. NR 106.07 and NR 205.065(7) Expression of Limits.

Parameter	Daily Maximum	Weekly Average	Monthly Average	Multiplication Factor (CV)
Chloride	**440 mg/L**	400 mg/L	**400 mg/L**	1.114 (0.1)

PART 8 – ADDITIVE REVIEW

Unlike the metals and toxic substances evaluated in Part 2, most additives have not undergone the amount of toxicity testing needed to calculate water quality criteria. Instead, in cases where the minimum data requirements necessary to calculate a WQC are not met, a secondary value can be used to regulate the substance, according to s. NR 105.05, Wis. Adm. Code. Whenever an additive is discharged directly into a surface water without receiving treatment or an additive is used in the treatment process and is not expected to be removed before discharge, a review of the additive is needed. Secondary values should be derived according to s. NR 105.05, Wis. Adm. Code. Guidance related to conducting an additive review can be found in *Water Quality Review Procedures for Additives* (2019).

Attachment #1

Additive Name	Manufacturer	Purpose of Additive including where added	Intermittent or Continuous Feed	Frequency of Use		Max Quantity Used gal/day	Avg Quantity Used gal/day	Potential Use Restriction mg/L	Is Additive Authorized in Current Permit?[1]
				Months per/yr.	Days/ week				
Sodium Bisulfite 40%	Hydrite Chemical Company	Peroxyacetic acid removal	C	12	7	100	40		Yes
NeutraQuat	HydrSolutions	Remove quaternary ammonium compounds	C	12	7	120	40	1.12	Yes
DP 3270 Polymer	Aquachem	Flocculant	I	varies	varies	55 lbs/day	55 lbs/day		Yes
Grandule-Maid	HydroSolutions	Anaerobic biopolymer	C	12	7	35	24		Yes
Ferric Sulfate 60%	Chemtrade	Phosphorus removal	C	12	7	350	250		Yes
E-1200 bacteria	Aquachem	Bacterial additive	C	12	7	50	20		Yes
Essential Micro 1	Hydrosolutions	Anaerobic miconutrients	C	12	7	20	10		Yes
Sodium hydroxide 30-54%	Olin Corporation	pH adjustment	C	12	7	450	275		Yes
Acetic Acid – Glacial FG	Hydrite Chemical Company	Cooling tower biocide	I	6	1	220	220		Yes

1. Evaluation are not necessary for additives that have active ingredients consisting only of chlorine, caustic soda (sodium hydroxide), hypochlorite, sulfuric acid, hydrochloric acid

DP 3270 Polymer, Grandule – Maid, Ferric Sulfate, Sodium Bisulfite, Sodium Hydroxide, Acetic Acid, and Aquachem E-1200 bacteria, and Essential Micro – These additives are treated or expected to be removed with the solids and not expected in the discharge at Outfall 009 or the products only contain active ingredients listed in the table's footnote above. Therefore, reviews of these additives are not needed.

Attachment #2